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[0001] The invention goes out from a method to measuring a hop with a multi-cell radio system, whereby at least two base stations are in a spatial predetermined distance arranged to each other, whereby their hops will receive themselves to at least partly overlap and from a mobile terminal, and/or a control unit to the genus of the beside-ordered claims 1, 11, 14 and 16. Bei bekannten Mehrzellen-Funksystemen, die beispielsweise nach dem DECT- (Digital Enhanced Cordless Telecommunication), Bluetooth- Standard oder dergleichen aufgebaut sind, wird die Topologie des Mehrzellen-Funksystems - die Lage und Anordnung der einzelnen Basisstationen - nicht automatisch eingemessen. Rather a single mobile terminal, which is in a telecommunications network, must look for active for an appropriate, neighboring base station, on it for example with the so called, Handover', i.e. with changes of the radio cell during an active compound, to switch can. The same problem exists also with the so called, Roaming', i.e. with the change of the radio cell without active compound.

[0002] With the Handover or also with the Roaming the mobile terminal must the field strength of the receivable neighboring base stations first measure and evaluate. Only thereafter it can decide whether and to which base station it must change if necessary. The time for the measurement and evaluation of each single received radio signal is dependent of used transmitting and pool of broadcasting corporations and can relative be time-consuming.

[0003] The invention process for measuring a hop with a multi-cell radio system and/or the control unit with the characterizing features of the beside-ordered claims 1, 11, 14 and 16 has in contrast to this the advantage that the mobile terminal does not have to measure the existing topology of the multi-cell radio system. Rather it can infer the data with the relevant topology of the neighboring base stations from a table, which has the mobile terminal in its memory stored or from the current base station transmitted gets. Thus only does not become saved by measuring the required time in advantageous manner. As advantage it results that the energy required for the field strength measurement of the neighboring base stations does not have to become any longer applied, so that the mobile terminal with a battery charge prolonged operative remains.

[0004] By the measures listed in the dependent claims favourable developments and improvements of the 11 method listed in the beside-ordered claims 1 and and/or the control unit are given. As particularly favourable with the fact considered becomes that the table is formed as adjoining cell list and contains the essential data of the neighboring base stations, like their relative field strength of the single base stations among themselves. With these data for example the relative position of the neighboring base stations can become estimated.

[0005] Favourable is also to store in the table other data like the load information. The information over the current load of a base station is important because is apparent from this the number of the straight active compounds. So prevented can become with this identification number the example that the mobile terminal changes on an overloaded neighboring base station.

[0006] As particularly simple and favourable solution for the creation of the table considered becomes that a base station than transmitters and all remaining base stations than receivers are switched alternately in each case. In this way the base stations switched as receivers can the hop-strong of the straight sending base station measure and store. After cyclic exchange between the single base stations a distribution results over the single measured field strength of the neighboring base stations for each base station, which becomes stored in the list.

[0007] If the list in form of the adjoining cell list became created, can the mobile terminal, for example a Handy or such a thing, which use stored data in the list after a predetermined algorithm for a call setup. Natural one can favourably steer also the associated base station with these data the call setup to the mobile terminal.

[0008] In the case of a variety of base stations in a multi-cell radio system the other favourable solution results that each base station has the data to its neighboring base stations stored. Thus results an entire topology for all relevant base stations of the multi-cell radio system, which becomes transmitted to the control unit and/or the mobile terminal.

[0009] As other advantage also considered become that the table for the planning of hops can become used. Thus can be uncovered for example radio shadings, strong undesirable intersections or other errors in the radio network light.

[0010] The duration of measuring is dependent of used transmitting and pool of broadcasting corporations and can with several seconds lie. Measuring the whole system can take thus several minutes in claim. Therefore complete measuring of the hop will be the exception and only performed ones will become, if for example the multi-cell radio system in operation taken becomes or is added a new base station.

[0011] With an alternative embodiment of the invention also provided are to renew the table to predetermined times automatic. This could be for example in operatingweak times like at night, at holidays or such a thing.

[0012] The application of the method is suitable in particular with radio networks, those after the DECT, Bluetooth standard or similar standard and/or. Networks work.

[0013] The control of the single base stations by a common control unit has the advantage that single Sendeund receipt phases of the base stations runs off temporal controlled. The other thereby the gained data can become to the control unit transmitted and an entire table summarized here.

[0014] An other favorable solution for the control unit becomes also that not only the field strength of the neighboring base stations, seen in the fact, but also other data becomes as the example the load information in the table stored. Thus for example a congestion of the base station coming into question can become recognized and if necessary avoided despite good receivings characteristics.

[0015] The control unit is in alternative embodiment of the invention in a present multi-cell radio system control integrated. Thus the different functions, as for example the switching of the sending on the receive mode, can become favourable on each other tuned and the installation simplified.

[0016] The invention is the basis the object to simplify with a multi-cell radio system a measuring of the hop. This object becomes with the features of the beside-ordered claims 1 and 11 dissolved.

[0017] An embodiment of the invention is in the drawing shown and becomes in the subsequent description more near explained.

Fig 1 shows a multi-cell radio system in schematic representation and Fig 2 shows a table with an adjoining cell list of the base station 2.

[0018] The schematic representation of the fig 1 shows a multi-cell radio system. It exhibits for example four base stations 2 to 5, which are preferably 1 connected over electrical connection

lines 6 with a central control unit. The central control unit 1 essentially steers the sending and receive mode of the single base stations 2 to 5 after a predetermined algorithm, the measurement of the field strength, the application of a table with a neighbourhood list and the transfer of data to the single subscribers. The central control unit 1 can be as separate unit at an appropriate location established. In alternative embodiment of the invention also provided are to integrate the central control unit 1 into a multi-cell radio system control which is in the telecommunications system present anyway. Thus for example the installation of the telecommunications plant can be simplified.

[0019] The base stations 2 to 5 are spatial distributed in a space or in an area with the locations A, B, C and D arranged. The base station 2 points the distances A, b in this embodiment to their neighboring base stations 3 to 5 and/or. C up. The corresponding distances A, b and/or. C receive the base stations 3 to 5 different values for the hop-strong (RSSI, receiver signal Strength indicator) of the sending base station 2.

[0020] The base stations 2 to 5 are for example interconnected to a telecommunications plant and work after one of the known standards like the DECT, Bluetooth standard or such a thing. These standards are known by SE and must therefore not more near explained become.

[0021] The single base stations 2 to 5 become preferably so established that their hops at least partly overlap. Thus is ensured that a mobile terminal 7, which can be for example a radio receiver like a Handy, a data receiver or a similar apparatus stands always with one of the base stations 2 to 5 over the radio network in connection, if it is in the respective field more stationary or in the area moved.

[0022] Paths of the limited ranges of the transmitters both in the mobile terminal 7 and in the base stations 2 to 5 an active or also a passive connection (Handover must and/or. Roaming) with the change of a radio cell (base station) to the corresponding new base station 2 to 5 to be advanced.

[0023] With the selection of an appropriate base station 2 to 5 this object had to take over so far the mobile terminal 7 and first the topology, D. h. of the receivable base stations 2 to 5 measure and then due to the evaluated data, the hop-strong in particular, decide, to which base station 2 to 5 it must change. In addition it comes that this procedure - dependent of the used standard - is time-consuming relative.

[0024] While the raising or also, if the example a new base station is to become inserted into the multi-cell radio system, the hop must become new in-measured. The other measuring the hop gives references over possible sources of error, which could be sought out otherwise only heavier with the planning of a new multi-cell radio system.

[0025] In the subsequent one the operation of the invention process becomes measuring a hop more near explained with a multi-cell radio system, for example with a DECT system. By measuring the present topology becomes detected. The single field strength becomes measured and regarding the respective sending base station 2 to 5 evaluated. Additional ones can become also other parameters like the load information or such considered. The determined values will preferably in form of a table 8, like it late still fig 2 more near explained becomes, listed. This table 8 becomes to the central control unit 1, the base stations 2 to 5 and/or the mobile terminal 7 transmitted.

[0026] As mentioned became before, measuring of the hop becomes according to invention with the help of the central control unit 1 controlled. For example with the system start, i.e. while the raising of the multi-cell radio system first the central control unit 1 requests all connected base stations 2 to 5 to look for its neighbour stations. In addition a base station, in fig 1 first the base station 2, becomes into their transmit mode switched. The base station 2 preferably sends with its full transmission power. All remaining base stations, here the base stations 3 to 5, become switched into an appropriate receiving mode.

[0027] All base stations 3 to 5, the signals of the sending base station 2 received, store first this information. In response of used transmitting and pool of broadcasting corporations the SE

base stations 3 to 5 a corresponding message can to the central control unit 1 send (direct message). Alternative one can become also an indirect message to the central control unit 1 sent. It means that the received base stations 3 to 5 send the message to the sending base station 2 and pass these on the response to the central control unit 1.

[0028] The sending and receive mode conditions differ with the single radio standards. The answer message must become then corresponding adapted.

[0029] In the answer message to the central control unit 1 the value for the received hop-strong preferably becomes as RSSI value indicated, with which the sending base station became to receive 2. With the later operation also other parameters, like the load factor, can be contained in the answer message operational disturbances or such a thing.

[0030] After for the base station 2 the topology values detected are, the central control unit 1 switches now the next base station, for example the base station 3 to a transmit mode and the base stations 2, 4 and 5 to reception. This Cycle repeated itself, until all hop-strong as well as their relevant parameter of all base stations are 2 to 5 detected.

[0031] The duration of measuring the hop of a base station can lie depending upon used transmitting and pool of broadcasting corporations with several seconds. Measuring the whole system can take thus several minutes in claim. Therefore complete measuring of the hop of a multi-cell radio system is rather a state of emergency, which should become only performed with important circumstances as with a system start, with the error or case of service or with changes of the operating characteristics of the multi-cell radio system.

[0032] When measuring the hop it is meaningful that the hops of the base stations 2 to 5 overlap in such a way with maximum transmission power that the neighboring base stations will still receive 2 to 5 in each case can.

[0033] After each single base station 2 to 5 all in range located neighboring base stations became 2 to 5 with their associated field strength measurement values determined, the created central control unit 1 for each base station 2 to 5 a table 8, as them become 2 subsequent explained in accordance with fig. Fig 2 shows a possible table 8 for the base station 2. For the other neighboring base stations 3-5 the table is 8 corresponding modified.

[0034] The table 8 is formed as neighbourhood list and contains for example for the base station 2 into their first gaps the names of the base stations 3 to 5. In the second gaps are registered the RSSI values for the hop-strong. A low RSSI value means with the fact that the base station is other remote as with a larger RSSI value. The RSSI of values indicates thus the relative distances of the single base stations 2 to 5, not their absolute locations.

[0035] In the third column load information is registered, which corresponds to the number of the current connections. These numbers change for continuous and become frequent updated corresponding during the current operation of the central control unit 1. Natural ones can become also other parameters in other columns of the table 8 stored.

[0036] The table codes become preferably sorted after the hop-strong and/or the load information. The assortment made after a predetermined algorithm for example in the manner that the most suitable base station 2 to 5 at highest location stands. With the Handover or Roaming then first switched can become on this base station.

[0037] After creation of the table 8 and transmission to the base stations 2 to 5 the multi-cell radio system can take up its operation. During the operating phase the table becomes 8 if necessary 7 transmitted to the mobile terminal.

[0038] As mentioned, the mobile terminal 7 receives the finished table 8 transmitted from the central control unit 1 and can then the corresponding table 8 by an intelligent selection algorithm to the most suitable base station switch. Own measuring of the hop is not any longer required.

[0039] An update of the measurement of the hop can become regular (automatic) operatingweak times or bottom certain, predominant conditions performed. For example with

installation of an additional base station the whole multi-cell radio system does not have to become new in-measured. It is sufficient, if the new base station goes into the transmit mode and all other base stations on reception switched are. Prerequisite participates that all base stations for the operation with terminals 7 operative remain.

[0040] After all neighboring base stations in range answered, the created central control unit 1 been added base station an adjoining cell list new for those. In the existing adjoining cell list of the already present base stations the new base station becomes additional listed with the measured RSSI values. This updated in each case table 8 becomes then all other base stations transmitted.

#### Reference symbol list

- 1 central control unit
- 2 (sending) base station
- 3-5 Base stations/receiving stations
- 6 Connection line
- 7 mobile terminal
- 8 Table
- A, b, C Distance
- A, B, C, D Locations



Claims of EP1304896

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1. Methods for measuring a hop with a multi-cell radio system, whereby at least two base stations (2-5) are in a spatial predetermined distance (A, b, C) arranged and connected over connection lines (6) with a control unit (1) to each other, and whereby the hops of the single base stations (2-5) at least partly overlap and are receivable by a mobile terminal (7), dadurch gekennzeichnet,  
 that generated for each base station (2-5) a table (8) with neighboring base stations (2-5) and them becomes associated parameters, whereby the content of the table of a base station (2), which a neighboring base station (3-5) associated is, with the help of which the subsequent method steps generated becomes:

- a) Activate the ready to receive shank of the corresponding base station (2);
- b) Send a defined signal by the neighboring base station (3-5),
- c) Receptions of the signal by the corresponding base station (2);
- d) Determine at least a predetermined parameter of the received signal by the corresponding base station (2);
- e) Entries of the determined parameter of the neighboring base station (3-5) into the table of the corresponding base station (2).

2. Process according to claim 1, characterised in that in the table (8) of a base station (2) data over the field strength of the sending fields of their neighboring base stations (3-5) to be registered.

3. Method after one of the preceding claims, thereby characterized,  
 dass in der Tabelle (8) einer Basisstation (2) Daten über Lastinformationen ihrer benachbarten Basisstationen (3-5) eingetragen werden.

4. Method after one of the preceding claims,  
 thus characterized,

that the table (8) becomes created by the fact that a base station (2) than transmitters and all remaining base stations (3-5) are than receivers switched alternately in each case, and that the base stations (3-5), switched on reception, measure the sending field-strong of the sending base station (2).

5. Method after one of the preceding claims, thereby characterized,  
 that the mobile terminal (7) and/or a base station (2-5) the data of the table (8) after a predetermined algorithm for a call setup, a Handover and/or a Roaming used.

6. Method after one of the preceding claims, thereby characterized,  
 that each base station (2-5) a table (8) created, are stored in which relevant data of neighboring base stations (2-5), and that these tables (8) to the control unit (1) and/or the mobile terminal (7) become transmitted.

7. Method after one of the preceding claims, thereby characterized,  
 that the table (8) for the planning of a hop used becomes.

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8. Method after one of the preceding claims, thereby characterized, that the table (8) becomes bottom consideration predetermined conditions, for example renewed with change of the connected base stations (2-5).
9. Method after one of the preceding claims, thereby characterized, that the table (8) predetermined times automatic renewed becomes.
10. Method after one of the preceding claims, characterized by an use with a multi-cell radio system, that for example after the DECT, Bluetooth standard etc. works.
11. Control unit to the carrying out the method after one of the preceding claims, whereby the control unit (1) for tax purposes is preferably connected over connection lines (6) with at least two base stations (2-5), thus characterized, that the control unit (1) is formed to switch successive one of the base stations (2) to sending and to switch the remaining base stations (3-5) to reception, that the receiving stations (3-5) are formed to measure the field strength of the sending base station (2) and that the receiving stations (3-5) are formed to store the measured field strength of the sending base station (2) in a table (8).
12. In such a way control unit according to claim 10, characterised in that the control unit (1) formed is to steer the receiving stations (3-5) that they store other data of the sending base station (2), preferably the load information in the table (8).
13. Control unit after one of the claims 11 and 12, characterized thus, that the control unit (1) is into a central multi-cell radio system control of a telecommunications system integrated.
14. Base station of a multi-cell radio system, whereby the base station (2) is in a spatial predetermined distance (A, b, C) arranged to at least a neighboring base station (3-5), and whereby the hops of the base stations (2-5) at least partly it overlaps and is receiptable by a mobile terminal (7), thus characterized, that the base station (2) is formed, in order to determine and the respective neighboring base station (3-5) associated in a table (8) store parameters of each neighboring base station (3-5) on the basis received signals of the respective neighboring base station (3-5).
15. Base station according to claim 14, characterised in that the parameters of the neighboring base stations (3-5), stored in the table, the field strength of their sending fields and/or their load information cover.
16. Multi-cell radio system, with a control unit (1) and at least two base stations (2-5), to each other and over connection lines (6) with the control unit (1) the connected arranged in a spatial predetermined distance (A, b, C) are, whereby the hops of the single base stations (2-5) overlap at least partly and are receiptable by a mobile terminal (7), thus characterized, that the control unit (1) is formed, in order to switch alternately one of the base stations (2) to reception and the residual base stations (3-5) to sending, and that the base stations (2) are formed, in order to determine and the respective neighboring base station (3-5) associated in a table (8) store parameters of a sending neighboring base station (3-5) on the basis received signals of the respective neighboring base station (3-5).